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OIC - 1572
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17 April 1961

MEMORANDUM FOR : The Record

SUBJECT : JT11D-20 Engine Program Review

1. Pratt & Whitney Florida was visited on 12, 13, 14 April 1961 by the writer for subject review.

2. A meeting was held 13 April with representatives of the AF-12 program for the purpose of updating funding requirements for the AF-12 engine development, prototype, and support phases. Of particular interest to Headquarters are the following:

(a) Some reduction in the total number of 10 AF-12 engines may result because of unit price increase.

(b) 15 June is the target for final contract negotiation.

(c) AF-12 electrical power requirements are enough greater than A-12 requirements to dictate redesign of the remote gearbox and without considerable effort, cooperation, and care a change in basic engine configuration. It is understood that the airframe contractor desires this change to be absorbed by engine configuration. In the writer's opinion, every effort must be made to keep this change in the airframe mounted remote gearbox which must be changed anyway because of greater power/load requirements. It is mandatory that A-12 and AF-12 engines be interchangeable (noninterchangeable if engine gearbox modified) in order to realize any benefit from the currently planned common pool spare engine support concept. AF-12 representatives concur with the writer.

3. Electric:

On 12 April after two hours operation, the trailing edge flaps failed. Examination by the writer one hour after failure revealed fatigue crack progression from the unsupported trailing edge corner radius of every flap and fatigue crack progression (approximately 1/2 - 2/3 forward from the trailing edge) along circumferential spot welds. The damage was not as severe as the previous failure.

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(a) The trailing edge failure appeared to be aggravated by the simultaneous combination of light gage material, corner radius, and sharp demarkation between support and non-support. A structural reconfiguration appears in order.

(b) The circumferential crack progressions appeared to be due to sonic vibration. This area of each flap is easy to "oil can" with finger pressure. Longitudinal stiffening such as corrugations or internal back-up structure beef-up appear worthy of consideration.

This failure has not been defined as an isolated transient like the previous failure.

Later moving pictures of the operation revealed some slight buffet with the plug out and a very marked high subsonic buffet with the plug in. This buffet which is felt to be mostly plug induced was contributory to crack progression but not necessarily the initiating force. Flutter, although not revealed visibly, is still felt to be the primary cause.

Pratt & Whitney proposal to rerun static tests without plug in order to focus on crack initiation is in work targeting release to interested parties the week of 17 April.

Investigation is underway to determine extent of modification to altitude facility for ejector rig installation should this become necessary.

4. Initial Engine Delivery:

In order to accumulate more control/engine development time sooner and to assure initial delivery engine flight worthiness, the initial X engine parts are to be phased into the development program permanently to increase the number of development engines from 5 to 7. The initial three delivery engines will therefore be Y engines. In order to fill out the total of 33 Y engines at the end of the delivery cycle, three development engines will be rebuilt to the complete Y configuration and delivered. The initial Y delivery engines therefore will be zero time engines except for green run and acceptance test.

25X1A Assurance was given the writer by [redacted] that because of this re-arrangement:

(a) No additional flight limitations will be imposed than would have been imposed before.

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(b) More and faster development time accumulation will be realized.

(c) The total of 33 full T engines will not be altered.

(d) Development, prototype, and support costs will not be altered.

(e) Better assurance of meeting initial delivery schedule with better engines will be realized.

5. Compressor:

(a) Due to bleed valve test stand malfunction, the compressor was subjected to violent surge which by chain reaction of creating a rotating vibratory stall resulted in seventh stage disc distortion and blade failure. Present feeling points to inadequate rim damping between sixth and seventh stages. Reasonable assurance exists for a satisfactory fix, however, parts lead time requirements may dictate temporary operational limitation. Further, the fact that some compressor surge is not uncommon to flight presents justification for some uneasiness.

(b) The current compressor speed-airflow match problem has not been resolved as hoped by stage restaggering. Proposal to re-coin certain blades is under investigation. This fix again involves parts lead time and therefore might require temporary flight limitation to Mach numbers slightly less [redacted] in order to keep airflow within inlet design limits.

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In the writer's opinion, problems involving the basic gas generator as those described above can be as and sometimes are more important than the more obvious control and accessory problems because they are usually deep rooted, less obvious, and apt to become surfaced only after considerable experience long after design and hardware freeze dates.

6. Turbine:

(a) After 20 hours at 1350°F turbine inlet temperature, a second stage blade failed. Examination has revealed a subsurface porosity which should have been detected during X-ray inspection.

(b) Second stage turbine vanes continue to show evidence of leading edge cracks due to thermal shock. It is proposed to add a high heat resistant shield to the leading edge. Performance and parts deliveries should not be affected.

7. Fuel:

25X1 (a) [redacted] has started fuel production under contract for

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PWA-523 specification. It is understood that initial batches ready for delivery fall slightly short of specification in luminometer number and distillation. All other spec. limits have been met. The reason given by [redacted] for this deficiency 25X1 is insufficient catalyst deliveries to date. Final catalyst deliveries are targeted for 15 May 1961. Pratt & Whitney is no longer accepting fuel to the modified specification thereby imposing a contractual price penalty upon [redacted] 25X1 for every gallon delivered which does not meet specification.

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(b) [redacted] has been requested to submit fuel shipping costs to Edwards Air Force Base and to submit a proposal for delivery based upon small quantities and complete monitoring from refinery to airplane.

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(c) Arrangements are underway to secure one barrel laboratory samples from [redacted].

(d) Clearance processing has been initiated for the [redacted] 25X1
25X1 [redacted] representatives.

(e) Probable J-57 control adjustments required for PWA-523 compatibility were discussed. These include very slight specific gravity and some heating value adjustment. Volitility as it may affect ground and air starting is being investigated.

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(f) On 12 April, [redacted] representatives visited PWA, Florida. Their statement indicated that certain internal personnel problems regarding their heretofore reluctance to produce PWA-523 fuel in excess of two million gallons per year have now been resolved. "They are eager and ready to produce 15 million gallons per year of PWA-523 @ 25¢ per gallon without capital expenditure".

8. Controls:

Fair progress has been made in this area through March. Detailed progress data since the 31 March suppliers meeting will be available shortly. Aside from this progress toward design solution, it should be remembered that these solutions must be turned into hardware in order to benefit the program.

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9. [redacted]

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[redacted] are both intensively engaged in the fuel soluble and seperately stored additive development. No firm

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solution has been reached to date.

25X1 In the writer's opinion, a security problem may evolve necessitating clearances for [redacted] who currently are aware of some obscure type of fuel known as PWA-523. As the fuel gains recognition throughout industry as it is just beginning to do now, before long it will be more widely identified as a very high performance fuel applicable to high Mach numbers and altitudes. The purpose for adding a [redacted] 25X1 to such a fuel may be quite obvious to certain people.

10. Hydraulic Pumps:

25X1 • In order to expedite seal leakage and other problem solutions an engineering representative from [redacted] will be permanently assigned to PWA Florida.

11. Weights:

As reported previously, current estimate indicates a T engine will be of material weight approximately 100 pounds over specification.

12. Afterburner:

Fifty two hours consecutive endurance without failure at maximum afterburning has been realized with the prototype afterburner. This represents a fair milestone in this relatively untested area. In the writer's opinion, this should be viewed with cautious optimism.

SIGNED

25X1 [redacted]
Development Branch
DPD-DB/P

cc: AFCIG-5

Distribution:
1&2-C/DB/DPD
3-SA/TA/DPD
4&5-DPD/DB
6-AFCIG-5
7-DPD/RI

DPD/DB/ROD:rew

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